



Nature's *Free*
Services



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by Glenda C. Booth

If you’ve been treated for an irregular heartbeat, you might thank the foxglove plant. If you know someone battling breast cancer, you might thank the Pacific yew tree. Ever taken penicillin for an infection? Thank a fungus.

These are examples of what are called “ecosystem services,” the many life-sustaining benefits people receive from nature, like clean air and water, fertile soil, pollination, flood control, and yes, medicines.

The prescription drug Digitalis, derived from the foxglove plant, is used at times to treat certain heart problems. Taxol, from the bark of the Pacific yew tree, inhibits the growth of certain cancers. The antibiotic penicillin, derived from *Penicillium* fungi, has treated bacterial infections since 1928. Before that, common infections often caused death.

What Are Ecosystem Services?

Nature provides fundamental services, upon which all life depends. Put another way by Pew scholar Robert Costanza, “Ecosystem functions refer variously to the habitat, biological or system properties or processes of ecosystems. Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions.”

The U.S. Forest Service offers this explanation: “Ecosystem services are the transformation of a set of natural assets (soil, plants and animals, air and water) into things that we value. For example, when fungi, worms, and bacteria transform the raw ‘ingredients’ of sunlight, carbon, and nitrogen into fertile soil, this transformation is an ecosystem service.”

Our natural assets are our life-support system. Viewed in economic terms, they are our natural capital. Not surprisingly, the *Millennium Ecosystem Assessment* prepared in 2005 by over 1,300 experts found that over 60 percent of ecosystem services worldwide are in worse shape than they were 50 years ago.

Many plants in the landscape, like the dazzling foxglove shown here, also have medicinal value for humans.

Plants and Trees

Plants provide food, fuel, and wildlife habitat. They conserve soil, filter water, and stem runoff. Nine of the top ten drugs originate from plant products. Of the leading 150 prescription drugs used in the U.S., 118 originate from natural sources and 74 percent of those, from plants.

Every hunter knows that forests are critical habitat for wildlife like bears, white-tailed deer, wild turkeys, ruffed grouse, and quail. But forests also reduce evaporation, enhance groundwater restoration, and absorb toxins and excess nutrients from runoff. A forest floor removes 85 to 95 percent of runoff pollutants, making that water more useable. Fifty percent of Virginia’s streams and rivers are impaired for recreation, according to the Department of Environmental Quality; given the link to forest cover, some communities are deciding that it is cheaper to protect forested watersheds and their services than it is to build and maintain new water treatment facilities.

Forests also act as “carbon sinks,” consuming more carbon dioxide, a major



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Gardens and wild spaces are therapeutic for the soul, contributing to our emotional well-being.



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Raptors such as the young Cooper’s hawk (shown here) help to keep rodent populations in check.

greenhouse gas, than they emit. Trees absorb other pollutants as well—ozone, carbon monoxide, and sulfur dioxide.

For homeowners, trees provide privacy, screen out objectionable views, reduce glare, and provide windbreaks. Because the leaves of deciduous trees absorb or deflect radiant energy from the sun, trees can lower air conditioning costs. “Property values of landscaped homes are five to twenty percent higher than those of non-landscaped homes,” International Society of Arboriculture officials estimate.

Trees even provide psychological services. A University of Illinois study found that hospital patients recovered from surgery more quickly when they could see trees outside their hospital room window.

Insects

Insects are the “little things that run the world,” renowned biologist Edmund O. Wilson has commented. And he has elaborated: “The truth is that we need invertebrates but they don’t need us. If human beings were to disappear tomorrow, the world would go on ... But if invertebrates were to disappear, I doubt that the human species could last more than a few months. Most of the fishes, amphibians, birds

and mammals would crash to extinction about that same time. Next ... the bulk of the flowering plants ... and the world would return to the state of a billion years ago ...”

Underrated as help-mates, bees, beetles, and butterflies pollinate fruits, nuts, crops, and vegetables. In total, those pollination services in the U.S. are valued between \$1.6 and \$5.7 billion annually, according to the World Wildlife Fund. Insects also disperse seeds, aerate the soil, recycle nutrients, eat waste, and function as predators.

Birds and Bats

Raptors, like hawks and owls, control rodents. Vultures clean up road-kill, a free sanitation service. Birds eat insect pests, like those that harm fruit trees and crops. Pennsylvania’s health commissioner in 1914, Samuel Dixon, noted another service of birds: “The duck is one of the greatest known enemies of the mosquito and therefore of yellow fever and malaria.” In their daily journeys, birds also fertilize the earth and disperse seeds that provide food, plants, timber, for example.

Bats, too, disperse seeds and pollinate plants. And they gobble up pesky mosquitoes on many hot summer evenings, perhaps as many as 1,000 in an hour.

Wetlands

Wetlands perform multiple ecosystem services, notably flood control. A one-acre wetland can store about three acre-feet of water, or one million gallons, according to U.S. Environmental Protection Agency officials. Wetlands filter pollutants and trap sediments and nutrients. Anglers know too well that sediments can bury fish eggs and excessive nutrient levels can lead to too much algae, which can eat up life-sustaining oxygen in waters.

Wetlands act as fish nurseries, as well. “Around two-thirds of commercial fish and most shellfish use tidal wetlands as spawning

and nursery areas,” notes Kathy Reshetiloff, U.S. Fish & Wildlife Service. “About one-third of the nation’s threatened or endangered wildlife also depend on wetlands for habitat.”

Dr. Kirk Havens, with the Virginia Institute of Marine Science, calls wetlands biological supermarkets. “In an area roughly the size of an average desk top, there can be as many as 8,300 animals,” he reports.

Wetlands also sequester carbon. Wetlands “...excel at pulling carbon dioxide out of the air and holding it long-term in the soil,” wrote William Mitsch and Blanca Bernal last year in the *Midwestern U.S. Journal of Environmental Quality*.

Coastal Habitats

People love to be near the water. Thirty-nine percent of the U.S. population, or 123 million people, live in coastal counties, reports the National Oceanic and Atmospheric Administration (NOAA), a number that could swell by nine percent by 2020. Half of the U.S. coast—around 11,200 miles—is “highly vulnerable” to sea-level rise, NOAA maintains, at risk of flooding, erosion, and loss of use.

Extreme weather events occurring more frequently complicate the picture even further. In the past three years, 11 storms have each created \$1 billion in damage in the U.S.

Superstorm Sandy in 2012 wreaked \$65 billion in devastation. Sandy spared Virginia some of the catastrophic injury it inflicted north of the state, but it did take a swipe at the commonwealth. In Virginia’s Chincoteague National Wildlife Refuge and Assateague Island National Seashore, boardwalks were tossed about and some roads and parking lots, undermined. Chesapeake and Suffolk saw flooding. Virginia Beach sustained \$5 million in damage and lost a half-million cubic yards of sand, city officials calculated.

Natural defenses like wetlands cannot totally protect areas against ferocious storms, of course, but wetlands can reduce risk. Shoreline



Healthy marshes not only serve to buffer storm action and absorb runoff, but are home to myriad fish and wildlife species, including the red-winged blackbird shown here.

Background ©Randy Shank. Red-winged blackbird ©Bill Lea.





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Beaches and barrier islands act as natural defenses against rising water during hurricanes and storm surges. Here, the beach at Assateague took the brunt of the impact from Superstorm Sandy in 2012.



Monarch butterfly on a Groundsel tree, ©Marie Mijaroy

marshes, underwater grasses, oyster beds, coral reefs, dunes, and coastal forests curb erosion, dissipate wave energy, and absorb flood waters like a sponge. A 2013 study concluded that they are “the nation’s strongest defense.” Stanford University’s Katie Arkema has written, “If we lose these defenses, we will either have to have massive investments in engineered defense or risk greater damage to millions of people and billions in property.”

Economic Engines

From the New River to the Blue Ridge Parkway to the Dismal Swamp, Virginia’s rivers, lakes, forests, mountains, meadows, coasts, preserves and parks provide recreation for outdoors lovers of all ages. Visitors to the state who engage in outdoor recreation spend around \$8 billion a year, fueling many local economies. Outdoor recreation generates \$13.6 billion a year in Virginia in consumer spending and 138,200 jobs, according to the Outdoor Industry Association.

The Piedmont Environmental Council (PEC) examined nine ecological services in

2011, citing benefits like cost savings, attractive communities, property value enhancements, and avoided health costs in the state. Heather Richards, PEC’s Vice President of Conservation and Rural Programs, says, “It’s important to show how the environment makes a fundamental contribution to Virginia’s economy. A few examples:

- ◆ Forests and wetlands provide \$5.2 billion in savings each year by preventing and slowing runoff and filtering water, thus cutting the public costs of treating water, for example.
- ◆ Barrier islands and beaches help coastal property owners and local governments avoid \$1.9 billion in costs associated with repairing roads and structures damaged by erosion and storms.
- ◆ Coastal wetlands, valued at \$450 million, provide habitat and nurseries for a wide range of aquatic life.
- ◆ Forests, grasslands, and croplands sequester 43 million tons of carbon dioxide (a greenhouse gas linked to global warming) that otherwise would go into the atmosphere or marine environments.

“Up to now, scientists have thoroughly investigated only one percent of Earth’s 250,000 plant species, and a far smaller percentage of its millions of animal species. Who knows what future benefits the now-unknown portion of biodiversity’s genetic library could provide us?”

—Norman Myers,
Environmental consultant

Valuing Ecosystem Services

The concept of ecological services poses questions like: What is nature worth? Can we put a dollar value on ecosystem services? The answer is, “Yes and no.”

Many people say we can and we should. “While it is often impossible to place an accurate monetary amount on ecosystem services, we can calculate some of the financial values. Many of these services are performed seemingly for ‘free,’ yet are worth many trillions of dollars...” argues the Ecological Society of America (ESA). ESA cites the Mississippi River Valley, where natural

flood protection has been undermined by draining and filling wetlands and re-engineering channels.

“The best things in life are free,” goes the saying. The fact that something is “free” does not mean that it is not valuable, however.

Dr. Gretchen Daily, Stanford University professor and a founder of the Natural Capital Project, offers, “Despite their vital importance, ecosystem services are generally taken for granted, scarcely monitored, and, in many cases, undergoing rapid degradation and depletion. This has serious—and potentially catastrophic—consequences for human well-being.”

Proponents of valuing nature’s services monetarily contend that natural assets are not typically factored into budgets, profit-and-loss statements, or balance sheets, but should be. “The economies of the Earth would grind to a halt without the services of ecological life-support systems, so in one sense their total value to the economy is infinite,” posits Costanza.

Ecosystem services are difficult to quantify. EPA scientists are researching ways to more accurately value the benefits of healthy ecosystems and help land-use managers, local governments, and other decision-makers move toward more sustainable practices.

Heeding Future Benefits

Environmental consultant Norman Myers has written, “From morning coffee to an evening chocolate snack, we benefit from our fellow species... Up to now, scientists have thoroughly investigated only one percent of Earth’s 250,000 plant species, and a far smaller percentage of its millions of animal species. Who knows what future benefits the now-unknown portion of biodiversity’s genetic library could provide us?”

Glenda C Booth, a freelance writer, grew up in Southwest Virginia and has lived in Northern Virginia over 30 years, where she is active in conservation efforts.

RESOURCES

- ◆ Natural Capital Project, Stanford Woods Institute for the Environment:
<https://woods.stanford.edu/research/centers-programs/natural-capital-project>
- ◆ National Wildlife Federation:
www.nwf.org/Wildlife/Wildlife-Conservation/Ecosystem-Services.aspx
- ◆ Ecological Society of America:
www.esa.org
- ◆ Piedmont Environmental Council:
www.pecva.org
- ◆ International Society of Arboriculture:
www.isa-arbor.com/
- ◆ Virginia Water Quality Assessment Integrated Report:
www.deq.virginia.gov/Programs/Water.aspx



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Recreating and appreciating nature’s bounty provide us with immeasurable benefits.